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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/662,358	09/15/2000	Taiji Noda	0819-0423	1724

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EXAMINER	
MAI, ANH D	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 11/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/662,358	Applicant(s) NODA ET AL.
	Examiner Anh D. Mai	Art Unit 2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 September 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) *1-5* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Amendment

1. Amendment filed September 5, 2002 has been entered as Paper No. 17. Claims 16-19 have been canceled. Claims 6, 8, 9, 11, 12 and 14 have been amended. Claims 1-15 are pending. Claims 1-5 have been withdrawn from consideration.

Response to Amendment

2. The amendment filed September 5, 2002 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "the heavy ions are implanted at such an implant energy as getting a range of the heavy ions located inside the extended high-concentration dopant diffusion layer".

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 11 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled

in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation "the heavy ions are implanted at such an implant energy as getting a range of the heavy ions located inside the extended high-concentration dopant diffusion layer" in the application as filed.

The specification discloses: the pocket dopant diffused layer 106 is also formed under (outside) the extended high-concentration dopant diffused layer 105". (page 16, lines 18-20).

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 6-13 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Burr (U.S. Patent No. 5,923,987).

Burr teaches a method for fabricating a semiconductor device that includes an extended high-concentration dopant diffused layer of a first conductivity and a pocket dopant diffused layer of a second conductivity as claimed including:

a first step of forming a gate electrode (342) over a semiconductor region (332) with a gate insulating film (340) interposed therebetween;

a second step of implanting heavy ions into the semiconductor region (332) using the gate electrode (342) as a mask, thereby forming a first ion implanted layer (347) of the second conductivity type (p^+), at least upper part of which is an amorphous layer;

a third step of implanting ions of a first dopant into the semiconductor region (332), in which the amorphous layer has been formed, using the gate electrode (342) as a mask, thereby forming a second ion implanted layer (336A) of the first conductivity type (n); and

a fourth step of conducting a first annealing process to activate the first and second ion implanted layers, thereby forming the extended high-concentration dopant diffused layer (336A) of the first conductivity type (n) through diffusion of the first dopant and the pocket dopant diffused layer (347) of the second conductivity type (p^+), which is located under the extended high-concentration dopant diffused layer (336A), through diffusion of the heavy ions, respectively,

wherein the pocket dopant diffused layer (347) includes a segregated part that has been formed through segregation of the heavy ions. (See Figs. 5H).

Note that, the implantation of heavy ions results in amorphization of the semiconductor substrate is well known. (See G.G. Shahidi).

With respect to claim 7, the segregated part of the pocket dopant diffused layer (347) of Burr appears to overlap with a profile of the extended high-concentration dopant diffused layer (336A).

With respect to claim 8, method of Burr further includes:

forming a sidewall spacer (335) on side faces of the gate electrode (342) after the third step has been performed;

implanting ions of a second dopant into the semiconductor region (332) using the gate electrode (342) and the sidewall spacer (335) as a mask, thereby forming a third ion implanted layer (336) of the first conductivity type (n); and

conducting a second annealing process to activate the third ion implanted layer, thereby forming a high-concentration dopant diffused layer (336) of the first conductivity type, which is located outside of the extended high-concentration dopant diffused layer (336A), has a junction deeper than that of the extended high-concentration dopant diffused layer (336A) and has been formed through diffusion of a second dopant.

With respect to claim 9, the heavy ions of Burr are implanted at such an implant energy as forming an amorphous crystalline interface, through implantation of the heavy ions, at a level equal to or deeper than a range of the first dopant and shallower than a range of the second dopant.

With respect to claim 10, method of Burr further includes:

implanting ions into a surface part of the semiconductor region (332), thereby forming a fourth ion implanted layer (334) of a second conductivity type (p) before the first step is performed; and

conducting a third annealing process to activate the fourth ion implanted layer, thereby forming a dopant diffused layer (334) to be a channel region.

With respect to claims 11 and 12, as best understood by the examiner, the heavy ions of Burr are implanted at such an implant energy as getting a range of the heavy ions (347) equal to

or deeper (outside) than a range of the first dopant (336A) and between one to three times as deep as the range of the first dopant (336A).

With respect to claim 13, the heavy ions of Burr includes indium ions.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Burr '987.

The implant dose of the heavy ions of Burr is within the order of magnitude as claimed.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum dose of the ions implanted. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Burr '987 as applied to claim 6 above, and further in view of Tsukamoto (U.S. Patent No. 5,399,506) (cited previously).

Burr teaches conducting the first annealing process using a rapid thermal annealing (RTA) as is well known to those skill in the art.

Thus, Burr is shown to teach all the features of the claim with the exception of explicitly disclosing the details of RTA process.

However, Tsukamoto teaches that RTA process is well known in the art including: a semiconductor region is heated up to a temperature between 950 °C and 1050 °C at a rate between 100 °C/sec to 150 °C/sec and then kept at the temperature for a period of time between 1 to 10 seconds.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to perform the RTA process of Burr as taught by Tsukamoto to activate the dopants.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum annealing temperature and the temperature rate of increase to activate the dopant. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

Response to Arguments

7. Applicant's arguments with respect to all claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
November 7, 2002

Wael Fahmy

SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800